CHAPTER

# 4

# Fiscal and Monetary Policy in the Growth Model

We can use the long-run growth model introduced in the previous chapter to study the long-term properties of monetary and fiscal policies. The framework for evaluating these policies is simple because the long-run growth model does not deal with the complexities of departures of the economy from full employment. Although a complete treatment of the short-run effects of monetary and fiscal policies must await the development of the complete model in Chapters 6 through 9, it is useful to establish the long-run properties now. They are an integral part of the complete analysis and important principles in their own right.

The long-run growth model is useful for evaluating the effects of monetary and fiscal policies over long spans of time; 10 years or more would be ideal and in most applications a minimum of about 3 years is necessary. Fiscal policy in the United States, for example, was more expansionary from 1985 to 1994 than from 1965 to 1974. The federal deficit averaged 4.1 percent of GDP in 1984–94 and 1.1 percent of GDP in 1965–74. What was the effect of this difference on interest rates? On exchange rates? On the trade balance? The growth model can provide good answers to these important questions. Another long-term fiscal policy issue is the effect on the economy of the reduction in defense spending in the 1990s, reflecting the demise of the Soviet Union.

In our discussion of monetary policy in this chapter, again the focus is on the long term and we do not deal with the departures of the economy from potential. For example, money growth was much higher in the 1970s than in the 1980s in the United States. The long-term growth model indicates that the main effect of this change on the economy would be a higher rate of inflation in the 1970s than in the 1980s. This was, in fact, the case.



## 4.1 HOW FISCAL AND MONETARY POLICY AFFECT REAL GDP IN THE LONG RUN

**Fiscal policy**, by definition, involves changes in government purchases ($G$), taxes ($T$), transfer payments to the private sector ($F$), and interest payments on the government debt ($N$). (The symbols in parentheses were introduced in Chapter 2.) Changes in any of these four items cause changes in the federal budget deficit, which is simply defined as total expenditures less taxes:

$$\text{Budget deficit} = G + F + N - T. \tag{4.1}$$

Fiscal policy is determined by the President and the Congress. The primary focus of fiscal policy in recent years has been to find a way to reduce the federal budget deficit. One of our purposes here is to understand why this would be a good policy for the long term.

**Monetary policy** involves changes in the money supply. In the United States the money supply is controlled by the Federal Reserve System (the Fed)—the country's central bank, established by Congress in 1913. There are important interactions between monetary and fiscal policies; this means that Congress, the President, and the Fed have a joint role to play in determining the overall stance of monetary and fiscal policies, or simply macroeconomic policy.

What are the effects of monetary and fiscal policies on output in the long run? By and large, fiscal policy will have effects on total output in the long term, while monetary policy will have almost no effect. To see why, let's look at the growth model. We know that in the long-term growth model with perfectly flexible prices, GDP is always equal to potential GDP and therefore depends only on the supply of the three productive factors: labor, capital, and technology. If monetary and fiscal policies are to affect GDP in this model, they must affect one or more of these three factors.

Consider first the effects on potential GDP of government spending, a key component of fiscal policy. A change in government spending, such as a decline in defense spending, does not immediately have any substantial effect on the *supply* of the three productive factors. If the government decides to build fewer missiles, the supply of labor does not decline, according to

the growth model. Nor, in the absence of a reduction in R&D spending, is there a change in technological know-how. If there is some increase in private investment in the economy to fill the gap left by the decline in defense spending, then eventually this will increase the supply of private capital; however, this increase in the supply of capital will initially be small relative to the existing size of the capital stock and will not have a noticeable effect on GDP for several years.

What about the effect of the other major components of fiscal policy? In the previous chapter we showed how changes in tax rates affect worker incentives. We noted that a tax-rate reduction improves incentives to work but also reduces the desire to work (through the income effect), so the net effect may be small unless the reduction is part of tax reform. An increase in tax revenues paid by consumers to the government will reduce income available for consumption and thereby decrease consumption. If investment increases as a result, then the capital stock will grow and real GDP will rise. But the effect on GDP will be relatively small for several years. Changes in interest payments or transfers from the government that do not affect incentives or investment will have no impact on real GDP.

Similar reasoning suggests that a change in the money supply will not affect the supply of the productive factors. There is no reason to expect an increase in the money supply—currency and deposits at banks—to change the incentive to work or to be more inventive. In the long-term growth model with perfectly flexible prices, an increase in the money supply will leave GDP unchanged. But with more money persistently chasing the same amount of goods, prices will rise. Hence, monetary policy can increase the inflation rate. Some economists feel that higher inflation reduces productivity and thereby reduces GDP—a possibility that we will pursue later in the book. If so, then monetary policy affects real GDP by affecting the rate of inflation.

## EFFECTS OF FISCAL AND MONETARY POLICY ON REAL GDP IN THE LONG RUN

1. In the long run, GDP depends only on the supplies of the three productive factors: labor, capital, and technological know-how.
2. Fiscal policy can raise GDP by stimulating labor supply or by inducing additional investment. For many policy changes, these supply effects are likely to be small in the short run but build up over time.
3. A change in monetary policy will affect the price level. Inflationary monetary policies may have some adverse effect on GDP.




# HOW FISCAL POLICY AFFECTS THE SHARES OF OUTPUT

In the previous section we looked at the long-run effects of fiscal policy on the *total amount* of real GDP. In this section we look at the effects on the *components*, or *shares*, of GDP. Recall that in Chapter 2 we presented the components of GDP using the simple accounting identity

$$Y = \underbrace{C + I + X}_{\text{Nongovernment purchases}} + \underbrace{G}_{\text{Government purchases}}, \quad \text{The Income Identity} \tag{4.2}$$

where $Y$ is GDP, $C$ is consumption, $I$ is investment, $X$ is net exports, and $G$ is government purchases.

Many of the long-run questions about fiscal policy involve the effects of changes in government spending as a *share* of output. For example, we might want to know what will happen if government purchases in the year 2000 are 20 percent rather than 15 percent of GDP. Or what difference it makes for interest rates if the deficit as a share of GDP is 1 percent in the late 1990s instead of 4 percent as it was in the 1980s. Equation 4.2 can be rewritten and interpreted in terms of shares of GDP if we simply divide both sides of the equation by $Y$. This gives

$$1 = \frac{C}{Y} + \frac{I}{Y} + \frac{X}{Y} + \frac{G}{Y}. \tag{4.3}$$

In other words, the shares of the different components of spending must sum to 1.

We now want to use Equation 4.3 to determine what happens to the components of output when fiscal policy changes. A quick glance at the equation shows that *a change in government purchases as a share of GDP must bring about a change in nongovernment purchases as a share of GDP by the same amount, but in the opposite direction.* For example, a decrease in government purchases of 3 percent of GDP must bring about an *increase* in nongovernment purchases of 3 percent of GDP. An increase in government purchases of 3 percent of GDP implies that nongovernment purchases must fall by 3 percent of GDP. This is straightforward arithmetic. It is also straightforward logic.

How much do consumption, investment, and net exports individually rise? Would consumption $C$, income $I$, and net exports $X$ each rise by 1 percent of GDP in the case of a cut in government purchases of 3 percent of GDP? Or would some other combination of percentages occur? The an-

## Interest-Rate Sensitivity of Consumption, Investment, and Net Exports

What brings about a change in consumption, investment, and net exports in the long-term growth model? We have simply used arithmetic and logic to show that such a change must take place. The economic mechanism involves interest rates. An increase in interest rates will tend to reduce investment, net exports, and consumption. A decrease in interest rates will have the opposite effect. These changes in interest rates, which accompany changes in fiscal policy, are what bring about the changes in the nongovernment components of output.

Why do consumption, investment, and net exports depend negatively on the interest rate? Consider consumption first. Consumption is expenditure by households. Higher interest rates mean that consumers will have to pay more to finance consumption of automobiles and other durables. These higher finance costs discourage consumption. For example, higher required payments on a car loan discourage purchases of cars. Higher interest rates discourage investment for similar reasons. Recall that investment is expenditures by firms on machines and equipment. Higher interest rates mean that firms will have to pay more to finance their investments, and thus higher interest rates discourage investment.

The relationship between interest rates and net exports is more complicated, involving two steps. First, recall from Chapter 2 that the exchange rate determines how expensive foreign goods are in comparison with American goods. When the exchange rate rises, foreign goods become cheaper compared with home goods (see page 45). Hence, with a higher exchange rate, Americans want to import more and foreigners want less American exports. With American exports falling and imports rising, net exports—exports less imports—decline. In other words, a higher exchange rate reduces net exports. Now the second step: Higher interest rates in the United States make U.S. assets a more attractive financial investment and drive up the value of the dollar. Hence, a higher interest rate tends to be associated with a higher exchange rate. Now combining these two steps, we see that higher interest rates tend to reduce net exports by raising the exchange rate.

Figure 4.1 shows the three negative relationships between the interest rate and (1) consumption, (2) investment, and (3) net exports. Note that in the diagram the slope of the consumption relationship is less steep than that of investment and net exports. This reflects historical observations that the sensitivity of consumption to interest rates is smaller than that of investment and net exports. Note also that the fourth panel on the far right in Figure 4.1 is the sum of consumption, investment, and net exports shares. This illustrates how the total nongovernment share $(C + I + X)/Y$ depends negatively on the interest rate. Having derived the interest-rate sensitivities of the major



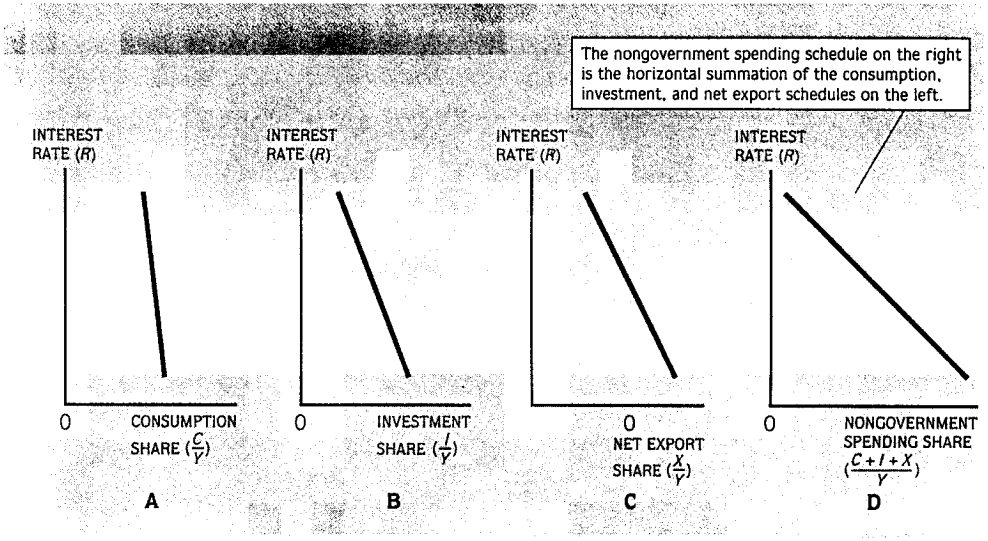


**FIGURE 4.1** Interest-Rate Sensitivity of Consumption, Investment, and Net Exports

Consumption, investment, and net exports shares all depend negatively on the interest rate $R$. Therefore, the sum of the shares depends negatively on the interest rate. Panel D is the sum of the shares in the other panels at each interest rate.

components of output, we now can proceed to derive the impact of a change in government purchases and other fiscal actions on the composition of output.

## Government Purchases

When government purchases fall, we know that nongovernment purchases rise. Figure 4.2 shows how a decrease in interest rates brings about this increase in consumption, investment, and net exports. First look at Panel D, which shows that lower interest rates must be associated with higher spending on nongovernment purchases. This panel also tells us how much interest rates must fall. Panels A, B, and C can then be used to determine by how much consumption, investment, and net exports individually rise. According to Figure 4.2, consumption rises by a smaller amount than investment does because consumption is less sensitive to interest rates than investment is. Net exports rise because the lower interest rates cause a decline in the exchange rate.

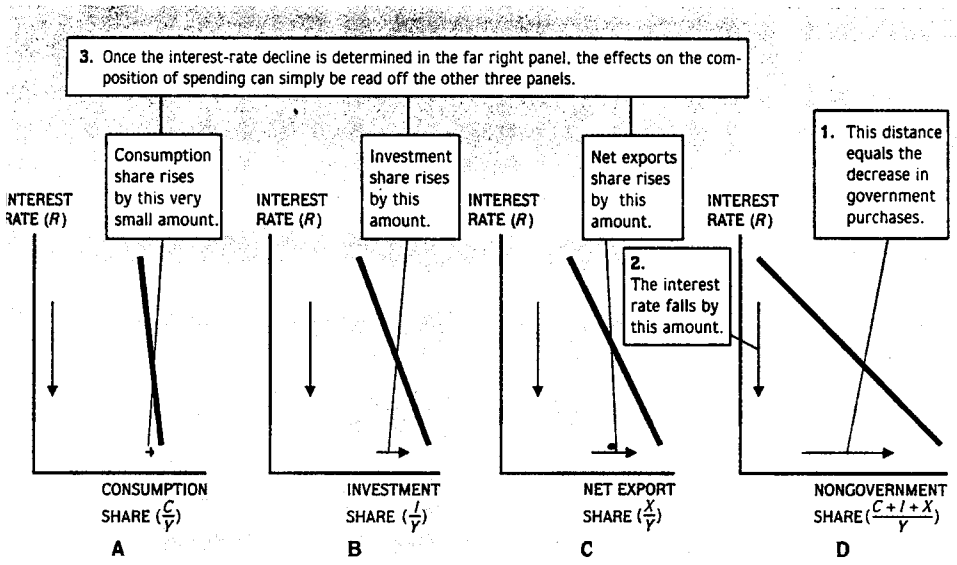


**FIGURE 4.2 Effects of a Decrease in Government Purchases**

The nongovernment share of GDP must rise by the same amount as the fall in the government share of GDP. This rise is brought about by a decline in interest rate *R*. The decline in the interest rate also causesxchange rate to fall.

## The Budget Deficit and the Trade Deficit

Note that this analysis illustrates the close connection between the budget deficit and the trade deficit. The cut in government purchases as a share of GDP will reduce the budget deficit as a share of GDP, as is clear from Equation 4.1. But as we have seen, the cut in government purchases also reduces the trade deficit (net exports rise). That is, the government's attempt to reduce the budget deficit has reduced the trade deficit.

## Other Fiscal Policy Changes

The analysis of other types of fiscal policy changes in the long run is very similar to the above analysis of a decline in government purchases. The analysis of an increase in government purchases is just the reverse of the analysis of a decline in government purchases. In this case, the interest rate



room for a greater government use of resources. The term **crowding out** is used to describe this process—higher government spending crowds out investment and net exports. A dollar of government purchases crowds out almost a dollar of investment and net exports and perhaps a small amount of consumption.

Changes in taxes will affect consumption. For example, higher taxes on consumption will reduce consumption because people have less to spend. But the reduction in consumption does not immediately affect potential GDP because the supply of the three productive factors does not change. Hence, the decline in consumption must result in an increase in net exports and investment. The effects can be illustrated in a diagram similar to Figure 4.2 and are left as an exercise at the end of the chapter.

Figure 4.3 illustrates how well the model works in predicting the effects of policy changes. It compares GDP shares in 1970–74 with those in 1990–

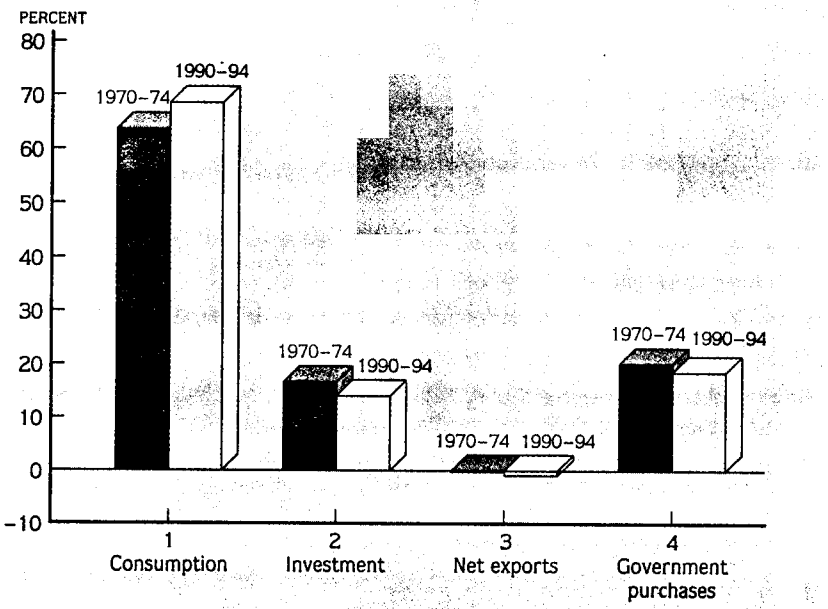


**FIGURE 4.3 Changes in GDP Shares between 1970–74 and 1990–94**

Because of tax cuts and other factors, the consumption share rose. The share of government purchases fell, but not by as much. Both the investment and net export shares fell as well

## NEW RESEARCH IN PRACTICE
## How Should We Divide $8 Trillion in GDP?

4.1 and 4.2 may seem remarkably simple
ıe complexity of the policies being consid-
hat is the beauty of the long-run frame-
t does not require an elaborate system of
ns to derive results about the allocation of
ıong different uses–consumption, invest-
ıovernment, and net exports. It demon-
how, if the government uses a larger share
, the private sector has to use less. Interest
ay the role of determining whether it is in-
nt, consumption, or net exports that gets
d out.

bert Stein of the American Enterprise Insti-
ıd formerly chairman of the Council of Eco-
Advisers, has suggested a framework for
ılysis of the federal budget which is based
notion of allocating different components
to different uses. He argues that federal
policy should be viewed more broadly as
ing GDP rather than simply budgeting fed-
penditures. His book on the subject, *Gov-
the $5 Trillion Economy*, describes his pro-
in detail. The theoretical framework that
es his practical suggestions is essentially the
ın framework described in Section 4.2.

in's basic point is that decisions about the
l budget should be based on two consider-
(1) an ordering of national priorities and
'iew of the relation between the budget and
ıievement of those priorities. Clearly, people
ve widely different views about priorities. To
national health insurance is a high priority.
; feel that we need more roads and bridges
:r-optic cable lines. People have different
about defense spending in the aftermath of
ıld War. Others are concerned that we are
ending enough on education.

ɔple also have different views on the efficacy
lget policy for achieving those objectives.
:he long-run economic analysis can be very
in analyzing both incentives to work, save,

To see how Stein's proposals would work, consider the following.

**Shares of GDP in 1984 and 1994 (percent)**

| | 1984 | 1994 | Change |
|---|---|---|---|
| Defense | 6.2 | 4.3 | −1.8 |
| Other federal | 2.1 | 2.1 | 0.1 |
| State and local | 10.3 | 11.0 | 0.6 |
| Domestic investment | 16.3 | 13.9 | −2.4 |
| Consumption | 65.1 | 68.7 | 3.5 |

Domestic investment is total investment less the trade deficit. It is the accumulation of net wealth in the United States. The figures show three essential facts about the mid-1990s compared with the mid-1980s: (1) Defense spending was much lower, (2) consumption was much higher, and (3) investment was much lower.

Now consider two options for budgeting GDP in the year 2000 using Stein's approach. For convenience focus on a single year.

**Options for Shares of GDP in 2000 (percent)**

| | Option 1 | Option 2 |
|---|---|---|
| Defense | 4 | 2 |
| Other federal | 2 | 2 |
| State and local | 10 | 12 |
| Domestic investment | 15 | 17 |
| Consumption | 69 | 67 |

Compared with 1994, option 1 keeps expenditures on defense about constant, while option 2 cuts defense in half. Both options also have more expenditures on investment than in 1994, but option 2 adds two more percentage points. That re-



tion 2 is more investment oriented. Option 2 has two more percentage points devoted to state and local purchases, which are dominated by education.

Choosing between these two options—or indeed many other possibilities—is one of the functions of our political system and government. Especially in comparison with the shares of the mid-1990s, these options represent significant differences in economic policy and would have profound effects on the evolution of the United S economy. A shift in the composition of spendi from the levels in the mid-1990s to either of two options would involve movements in inte and exchange rates. The model in Figure 4.1 tell us how this would happen and by how mu interest and exchange rates would change. It hard to imagine a more practical application o simple long-run model.

94. Two policy changes occurred during the 20 years separating the two periods. First, taxes on saving were raised, compared to consumption, through the elimination of savings incentives such as through tighter restrictions on individual retirement accounts. Families had more resources at their disposal, and they consumed more. Second, government use of resources fell, as measured by the share of government purchases in GDP. However, the rise in the consumption share was 4.9 percentage points of GDP (from 63.6 percent of GDP to 68.5), much larger than the fall in government purchases, which was only 1.6 percentage points of GDP. The net effect of policy changes was to make investment fall by 2.6 percentage points and net exports fall by 0.7 percentage points of GDP.

## Importance of the Long-Run Assumption

Where does the assumption about the long run fit into these calculations? Clearly, the shares of output add up to 1 in both the long run and the short run. The answer is that the long-run assumption makes sure that other things besides interest rates do not affect the shares of spending in GDP.

For example, as we will show in later chapters, if we cut government spending by 3 percent of GDP in one fell swoop, real GDP itself will fall in the short run, possibly by more than 3 percent. A fall in real GDP will result in an even sharper decline in investment as businesses see their sales falling. The share of investment in GDP will fall rather than rise. The results in this section would be all wrong and terribly misleading to policymakers if applied in the very short run. The long-run assumption allows us to view the economy on its long-run potential growth path. Hence, there will be no sharp movements in GDP.

The relationship between the short run and the long run will be clearer after we have studied the departures of real GDP from potential. Then we will see that the results obtained through these simple share calculations are exactly the same as long-run calculations that will be obtained with the more

## NEW RESEARCH IN PRACTICE
## International Policy Coordination

e net exports ($X$) appear in the income iden-
e long-run analysis of the composition of
as applications for international macroeco-
policy. For example, a reduction in govern-
pending raises net exports (reduces the
leficit). This analysis underlies many interna-
discussions of fiscal policy that occur at mul-
al forums such as the Organization for Eco-
Cooperation and Development (OECD) in
the International Monetary Fund in Washing-
nd, more frequently, the group of finance
ers of the seven largest industrial countries
nonly called the G-7). The analysis also forms
derpinning of bilateral negotiations.
e particular application illustrates very well
his type of analysis is used in practice. The
ation occurred as part of a bilateral coordina-
ffort between the United States and Japan
n as the Structural Impediments Initiative
One of the objectives of the SII was to reduce
he United States trade deficit and the Japa-
rade surplus. Such a reduction, it was hoped,
l help reduce trade friction between the two
ries and ease protectionist pressures. The SII
were always meant to be a two-way street:
the United States and the Japanese would
policy changes.
ne United States government's economic anal-
tressed that the U.S. trade deficit as a share
)P would go down if the U.S. budget deficit
share of GDP went down, assuming that no
factors that would offset this changed. The
analysis suggested that the Japanese surplus
d go down if the Japanese increased the share
)P devoted to public infrastructure investment
pan. These are both long-run propositions
can be handled with the long-run model. Both
ositions can be proved with the simple dia-
ns in Figure 4.2. You should try to do it. What
ld happen to interest rates and exchange
?

agreed to increase government infrastructure investment in Japan over a 10-year period. The government agreed to increase such investment by ¥430 trillion during the 1990s. That would raise the share of investment in GDP about 1 percent by the end of the 10 years compared with what it otherwise would have been. For its part, the United States offered the five-year $500 billion reduction in the U.S. budget deficit in the 1990 budget agreement.

International policy coordination seems mysterious to outsiders. How much influence does one sovereign government have on another? Some argue, for example, that coordination efforts like SII or the work of the G-7 have little effect; governments only agree to do what they would have done anyway. For example, even before SII started, many Japanese had argued that more public infrastructure investment was needed. And in the United States there was already a consensus that something should have been done to reduce the budget deficit. So maybe these and other actions would have occurred without coordination efforts. It is difficult to know for sure. Certainly, in the discussions there is a notion of making concessions, for example, increasing infrastructure investment in Japan in exchange for something else from the United States. There is also the element of diplomacy and international goodwill, the importance of which is hard to measure.

Note that there would have been other ways for the Japanese to reduce their trade surplus. Increasing consumption as a share of GDP was discussed in the preliminaries to the SII talks, but the United States government felt that it would not be good economic policy to promote antisaving in any country, especially in a decade in which there appeared to be a shortage of saving around the world. Hence, the United States position was that the gap between saving and investment in Japan would be better reduced by increasing investment



## FISCAL POLICY AND THE COMPOSITION OF OUTPUT

1. In the long-run growth model, an increase in government purchases will raise interest rates and reduce (crowd out) investment and net exports. The exchange rate will also rise.
2. The budget deficit and the trade deficit are closely related. A decrease in government spending which lowers the budget deficit will also lower the trade deficit.
3. The interest rate is a key factor in the analysis of fiscal policy. Consumption and especially investment and net exports are negatively affected by higher interest rates.


# MONEY AND INFLATION

In the previous section, we discussed how the real interest rate divides output among consumption, investment, government, and net exports. We showed how fiscal policy affects these variables. Now we consider the long-run behavior of another important macroeconomic variable, the inflation rate. **Inflation** is the rate of increase in the price level. In order to explain the price level, and thereby inflation, we need to consider the demand for and supply of money. In the long-run growth model, the price level is determined by equating money demand to money supply. Monetary policy determines the money supply.

## The Demand for Money

When we speak of **money**, we have a rather special meaning in mind. Money is the currency issued by the Federal Reserve—for example, coins and dollar bills—together with the checking account balances held by the public in banks. Money is used to facilitate the purchase and sale of goods. When we buy goods, we usually pay with currency or with a check. Money does not include the much larger amounts of wealth held in mutual funds, bonds, corporate stock, and other forms, even though these forms of wealth are measured in dollars, because they are not usually used to pay for goods.

1. ***People will want to hold less money when the interest rate is high and, conversely, will want to hold more money when the interest rate is low.***

This means that there is a negative relation between the demand for money and the interest rate $R$. People hold money for transactions purposes, to pay daily expenses and monthly bills. But they could obtain higher earnings by keeping their wealth in other forms, such as savings accounts or bonds. Currency pays no interest. And even though many checking deposits now pay interest, the rate is less than on other forms of wealth. Because of this, people tend to economize on the use of money for transaction purposes. A common way to do this is to go to the ATM or bank more often to withdraw money from a high-interest savings account to obtain currency, or simply to transfer funds to a lower-interest checking account. With more frequent trips, a smaller amount can be withdrawn each time from savings accounts. This means that, on average, a smaller amount of currency or checking balances will be held by the individual. For example, you could go to the ATM every week, rather than every month, to obtain currency and thereby hold a smaller amount of currency on average.

How much economizing will occur will depend on the interest rate. The interest rate $R$ represents how much a consumer or firm could earn by holding more of their wealth in forms that pay full interest instead of in currency, which pays no interest, or checking deposits, which pay less than full interest. Clearly the more that can be earned by holding those other forms—the higher $R$ is—the less money an individual or firm will want to hold.

2. ***People want to hold more money when income is higher and, conversely, less money when income is lower.***

The more a family receives as income, the more the family will normally be spending, and the more money the family will need for transaction purposes. When income increases, the transaction demand for money increases. More money will be needed to buy and sell goods.

This means that there is a positive relationship between income $Y$ and the demand for money. As income in the economy increases, on average each family's income increases and the demand for money in the entire economy increases.

3. ***People want to hold more money when the price level is higher and, conversely, less money when the price level is lower.***

If the price level rises, people will need more dollars to carry out their transactions, even if their real income does not increase. At a higher price level, goods and services will be more expensive; more currency will be



To summarize these three basic ideas, the demand for money depends negatively on the interest rate $R$, positively on income $Y$, and positively on the price level $P$. An algebraic relationship that summarizes the effect of these three variables on the demand for money is presented in the following equation:

$$M = (kY - hR)P. \tag{4.4}$$

Here $M$ represents the amount of money demanded by firms and consumers. The other variables in Equation 4.4 have already been defined: $P$ is the price level, $R$ is the interest rate, and $Y$ is income or GDP. The lowercase symbols $k$ and $h$ are positive coefficients: the coefficient $k$ measures how much money demand increases when income increases; the coefficient $h$ measures how much money demand declines when the interest rate increases.[1] Equation 4.4 is called the **money demand function**. It is a more complicated algebraic expression than the equation we used previously for consumption and investment demand. The money demand function shows that money demand depends on three variables (the interest rate $R$, income $Y$, and the price level $P$), whereas consumption demand and investment demand each depend on only one variable.

When studying algebraic relationships like the money demand function in macroeconomics, it is very important to distinguish between the constants and the variables. Sometimes the constants are called **coefficients**. In the money demand function the variables are $M$, $Y$, $R$, and $P$. The constants, or coefficients, are $k$ and $h$. Variables move around; constants stay fixed. To highlight this important distinction, we use lowercase letters for constants and uppercase letters for variables. This convention is used throughout this book.

**EXAMPLE.** If $k$ equals .1583 and $h$ equals 1,000, then Equation 4.4 looks like this:

$$M = (.1583Y - 1{,}000R)P.$$

If income $Y$ is \$6,000 billion, the interest rate is 5 percent ($R = .05$), and the price level $P$ is 1, then the demand for money is equal to \$900 billion. An increase in income of \$10 billion will increase the demand for money by \$1.583 billion. An increase in the interest rate of 1 percentage point will decrease the demand for money by \$10 billion.

[1]Note that the appropriate interest rate for the money demand function is the nominal rate. Most alternatives to holding currency, such as bonds, pay a nominal interest rate. In order to keep

## The Supply of Money

The Federal Reserve System determines the level of the **money supply**. In Chapter 14 we will study the interesting question of how the Fed goes about setting the money supply. For now, we will assume that the Fed has picked a certain level for the money supply.

We will also assume that the demand for money and the supply of money are equal. For this reason we do not introduce a new symbol to represent the money supply; the variable $M$ means both money supply and money demand. Since these are always equal, this should cause little confusion. (Recall that the symbol $Y$ also refers to two variables: income and GDP.)

How does the demand for money become equal to the supply of money? Suppose that the demand is greater than the supply. Since the supply of money is fixed by the Fed, the demand for money must fall if the two are to be equal. The demand for money can adjust down by an increase in the interest rate, a decline in the level of income, or a decline in the price level. For example, an increase in the interest rate will cause people to demand less money. In principle, all three variables could move, but in the long-run model income and the interest rate are determined outside the money market. Thus, only the price level can move to equilibrate the money market.

## MONEY AND THE INTEREST RATE

1. Money is currency plus the balances in checking accounts.
2. The demand for money falls if the interest rate rises, if income falls, or if the price level falls.
3. The Federal Reserve determines the money supply.

## Equilibrium in the Money Market

We will continue to assume that the economy is on the long-run growth path; GDP is at potential $Y^*$, and the interest rate is at the value $R^*$ determined in Figure 4.2. Money demand is

$$M = (kY^* - hR^*)P. \tag{4.5}$$

Money demand is proportional to the price level: if $P$ rises by 10 percent,



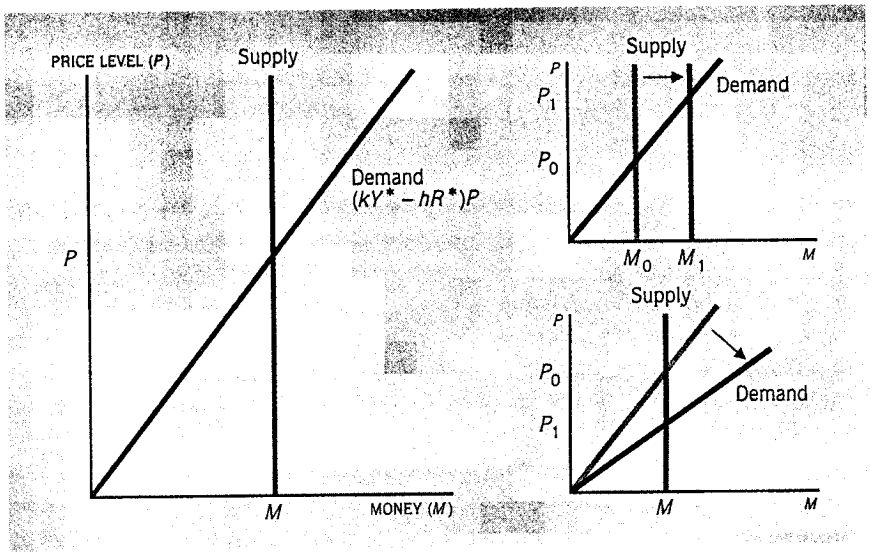


**FIGURE 4.4** Determination of the Price Level in the Money Market

On the left, the demand for money depends positively on the price level. The supply of money is fixed by the Fed. Equilibrium occurs at the intersection of supply and demand. On the top right, if the money supply rises, the price level rises in the same proportion. On the bottom right, if potential GDP is higher, the price level is lower.

in Figure 4.4. The algebraic expression for the price level that brings the amount of money demanded into equality with the amount of money supplied is

$$P = \frac{M}{kY^* - hR^*}. \tag{4.6}$$

When the Fed raises the money supply $M$ by 10 percent, the price level rises by the same 10 percent. With money more plentiful, its purchasing power falls and the price level rises. If potential GDP rises and the money stock remains the same, the price level falls; money becomes more valuable when the economy is producing a higher volume of goods and services. If government spending or some other determinant of demand falls, the equilibrium interest rate $R^*$ falls, and the price level also falls, to offset the rise in money demand.

In the long-run growth model, monetary policy is a very simple matter. The price level is proportional to the money stock. The money supply has

real variables are determined *separately* from the money variables. We can think first about the determination of employment and output and then, separately, about the price level.

## Inflation

Recall that *inflation* is the rate of increase of the price level. In an economy where GDP doesn't change, our model of the money market implies that the price level is proportional to the money supply (see Equation 4.6). More money simply raises prices. The Fed can choose whatever rate of inflation it wants just by raising the money supply by that percentage each year. For price stability, the Fed should keep the money supply constant from one year to the next. For 5 percent inflation, it should raise $M$ by 5 percent each year.

In a growing economy, the rate of inflation will be less than the rate of money growth. If $Y^*$ is growing over time, some money growth is needed just to keep the price level from falling from one year to the next.

Figure 4.5 shows the relationship between money growth and inflation in a group of seven countries. Money growth is measured over an 18-year

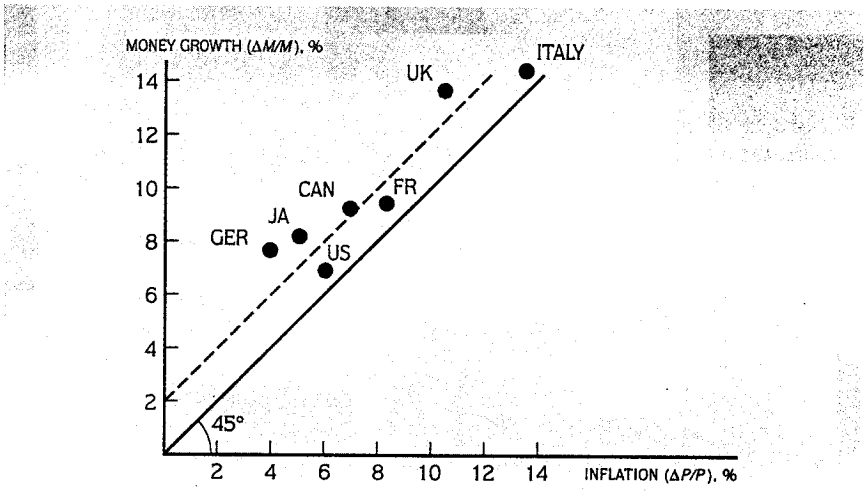


**FIGURE 4.5** Money Growth and Inflation in Seven Countries, 1973–90

The vertical axis shows the average annual growth rate of money supply over an 18-year period. The horizontal axis shows the average annual rate of inflation. Generally, the observations appear to lie about 2 percent above the 45-degree line, clustered around the dashed line. Growth in real



period, so the long-run analysis should apply even if recessions or booms are important over a 3- or 5-year period. If the relationship were as simple as 1 percent of inflation for each percent of money growth, all the observations would lie along the 45-degree line that equates inflation and money growth in the figure. Because growth of output also affects the relation between money growth and inflation, all the points lie above the 45-degree line. But it remains clear that money growth and inflation have a close relationship over a period of this length.

In the United States and all other economies, monetary policy and inflation are contentious issues. The United States has had episodes of inflation at rates of 10 percent and more, and some countries suffer hyperinflations, with rates of price increase of thousands of percent. Why does this happen if the central bank has direct control over inflation? There are two reasons that central banks don't deliver an inflation-free economy. In the United States, the reason is mainly that the long-run growth model does not describe the year-to-year movements of the economy. Instead, the economy can move away from potential. A monetary contraction is one of the forces that may cause a recession—a period when GDP is below potential. The fear of setting off a recession may prevent the Fed from cutting money growth, even though the reduced growth is just what the long-run growth model says is needed to end inflation.

In some smaller countries with less efficient tax systems, the second reason for inflation is important. The central bank—an arm of the government—issues large amounts of new money each year because the government is spending more than it takes in as taxes or from issuing bonds. The deliberate creation of high rates of inflation is one of the ways of financing government, though not a very good way. Severe deliberate inflation has not been part of U.S. economic policy since the Civil War.


## SUMMARY: THE CLASSICAL DICHOTOMY

The analysis of fiscal and monetary policies in this chapter illustrates an important property of the long-run growth model: Real variables like the interest rate and the composition of spending in the long-run growth model can be analyzed solely by looking at other real variables like government purchases. Nominal variables such as the money supply do not influence the level of GDP, the composition of GDP, or the level of interest rates. The diagrams in Figure 4.2 enabled us to determine the interest rate and the composition of output without considering monetary policy. In other words,

know all we need to know to determine the interest rate. Information about the money supply would not tell us anything else about the interest rate. Monetary variables such as the money supply affect only other nominal variables like the price level.

In the next chapter we begin to develop the complete model, in which this classical dichotomy does not always hold. But even in the complete model the results of this chapter are useful and important. They tell us the effects of monetary and fiscal policies that must hold in the long run in the complete model. Hence, the results derived in this chapter, with a minimum of algebra and technical detail, provide us with a benchmark from which to judge our results in the more complete model.

## REVIEW AND PRACTICE

### Major Points

1. The long-run growth model is a good guide to the effects of fiscal and monetary policy over periods of three years or more.
2. Fiscal policy involves changes in government purchases, transfers, and taxes.
3. Monetary policy involves changes in the money supply.
4. In the long-run growth model, changes in government purchases crowd out investment and thereby affect the long-run path of GDP.
5. An increase in the money supply has no effect on real GDP in the long run.
6. A decrease in government purchases as a share of GDP causes an equal increase in nongovernment purchases as a share of GDP.
7. Consumption, investment, and net exports depend negatively on the interest rate.
8. A decrease in government purchases causes a decline in the interest rate.
9. In the long run, the price level moves as necessary to equate the money demand to the money supply set by the Fed.
10. The price level is proportional to the money supply in the long run.
11. The Fed chooses the long-run rate of inflation by choosing the rate of money growth.

### Key Terms and Concepts

fiscal policy
monetary policy
crowding out
interest rate
interest-rate sensitivity
money market
demand for money
supply of money
money-market equilibrium
neutrality of money
inflation
money growth
classical dichotomy



### Questions for Discussion and Review

1. What is the difference between fiscal and monetary policies?
2. Explain why an increase in government purchases decreases nongovernment purchases by the same amount.
3. How does monetary policy affect real GDP?
4. What determines the interest rate in the long-run growth model? In what sense does the interest rate guide resource allocation?
5. What effect does an increase in government purchases have on output and the interest rate in the long-run growth model?
6. Describe how the price level is determined in the long-run growth model. Is the price level a good indicator of economic welfare?
7. What is meant by the neutrality of money?

### Problems

#### NUMERICAL

1. Consider a closed economy in which net exports $X = 0$. Suppose that consumption is insensitive to the interest rate, but that the share of investment in GDP rises by 2 percent for every 1 percent decline in the interest rate.
   a. By how much does investment rise as a share of GDP if government purchases decrease by 4 percent of GDP?
   b. By how much does the interest rate change?
   c. Using the growth accounting formula from Chapter 3, calculate how much more real GDP there would be if the capital-output ratio starts at 2.
2. Suppose that output is equal to potential at 4,000 and the equilibrium interest rate is .05. Money demand is given by

$$M = (.3Y - 4{,}000R)P.$$

   Money supply is set at 1,000 by the Fed.
   a. What price level is required for equilibrium in the money market?
   b. Suppose the Fed increases the money supply by 100. What is the new price level? What is the percentage change in the money supply? In the price level?
   c. Starting with a money supply of 1,000 and price level of 1.0, how does an increase in the interest rate from .05 to .10 affect the equilibrium price level? What could cause such an increase in the real interest rate?
   d. Starting again with $M = 1{,}000$ and $P = 1.0$, what effect does an increase in output from 4,000 to 4,500 have on the equilibrium price level?

#### ANALYTICAL

1. Investment spending and net exports are negatively related to the interest rate. In the hopes of increasing output in the economy, a regulation is imposed that precludes the interest rate from exceeding 5 percent. Suppose that in the absence